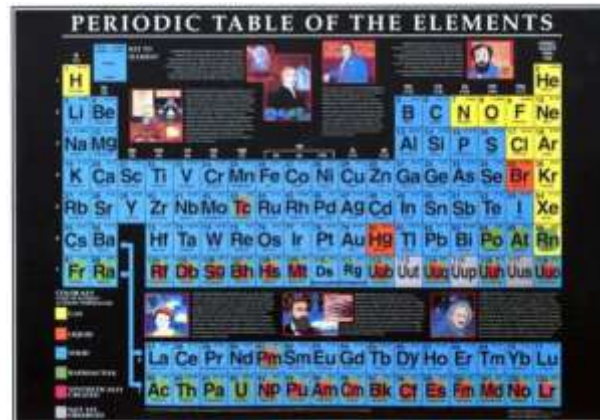


Bell Work

3-Nov-17

If an e^- escapes from an atom at a speed of 5.1×10^4 m/s and a wavelength of 1.0×10^{-3} m, what energy does it have?



PERIODIC TABLE OF THE ELEMENTS

H	He
Li Be	B C N O F Ne
Na Mg	Al Si P S Cl Ar
K Ca Sc Ti V Cr Mn Fe Co Ni Cu Zn Ga Ge As Se Br Kr	
Rb Sr Y Zr Nb Mo Tc Ru Rh Pd Ag Cd In Sn Sb Te I Xe	
Cs Ba La Ce Pr Nd Pm Sm Eu Gd Tb Dy Ho Er Tm Yb Lu	
Fr Ra Ac Th Pa U Np Pu Am Cm Bk Cf Es Fm Md No Lr	

EQ: What is a parts of our community that is organized in a periodic fashion and how does this help us?

OBJECTIVES:

Start exploring the sections of the periodic table.

Sections of The Periodic Table

If you need coloring tools come in before or after school 😊

Due end of class, 7-Nov-2017

Bell Work

7-Nov-2017

What metal is liquid at room temperature?
How many protons does this metal have?
What section of the periodic table is the
metal located in?

OBJECTIVES:

Determine the organization of a set of elements in a periodic fashion

EQ: What is a parts of our community that is organized in a periodic fashion and how does this help us?

Bell Work

6-Nov-2017

The periodic table is arranged by increasing _____?

The periodic table can be split up in to 2 pieces: transition metals and _____?

OBJECTIVES:

Graphically show how periodicity of the elements are depicted on Mendeleev's periodic table.

EQ: What is a parts of our community that is organized in a periodic fashion and how does this help us?

Organizing the Elements

A few elements, such as gold and copper, have been known for *thousands of years* - since ancient times

Yet, only about 13 had been identified by the year 1700.

As more were discovered, chemists realized they needed a way to organize the elements.

Organizing the Elements

Chemists used the *properties* of elements to sort them into groups.

In 1829 J. W. Dobereiner arranged elements into triads – groups of three elements with similar properties

- One element in each triad had *properties* intermediate of the other two elements

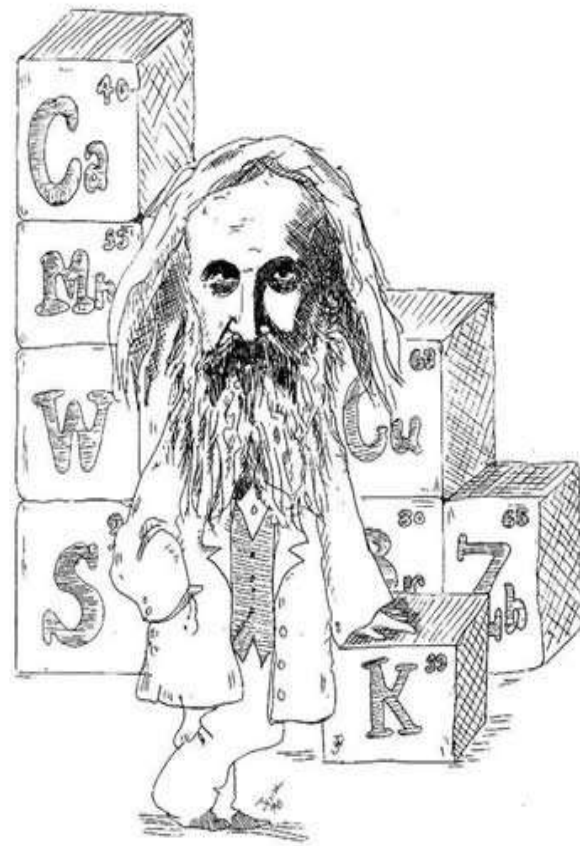


Mendeleev's Periodic Table

By the mid-1800s, about 70 elements were known to exist

Dmitri Mendeleev – a Russian chemist and teacher arranged elements in order of increasing atomic mass

Thus, the first “Periodic Table”



Mendeleev

**He left blanks for yet
undiscovered elements**

When they were discovered, he had
made good predictions

But, there were problems ☹:

Such as Co and Ni; Ar and K; Te
and I

Bell Work

8-Nov-2017

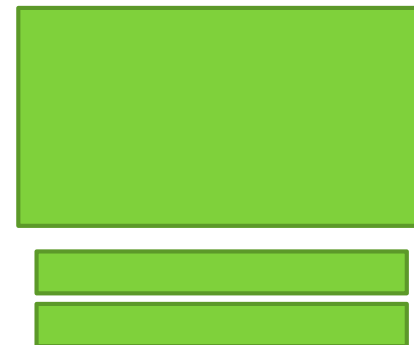
Get out your periodic table and locate the six sections of the periodic table;

Transition elements,
Halogens,
Alkali metal

Actinides,
Lanthanides,
Alkaline earth metals

Try to label a rectangle version of the table with each section from memory

Get a Yellow Lab handout from front of room “Plotting Trends” and start skimming over it



Turn In, 8.Nov.17

1. Flame Test Lab
2. Section of the Periodic Table
3. Creating a Periodic Table

Plotting Trends

A Periodic Table Activity

Your group will consist of three (3) people

You need to do all of the calculations first!

Plotting Trends

A Periodic Table Activity

Tips: Find the **maximum** value of the assigned physical property for the elements you are assigned

Let the length of the straw minus one (1.0) cm represent this maximum value

Use this portion
of the straw

Using this “straw” scale as a ratio, calculate the straw length that is needed to represent the assigned property for each element in your list



Plotting Trends

A Periodic Table Activity

Each group chooses or is assigned 1 element property:

1. Atomic mass (periodic table),
2. Atomic radius (Appendix A, Table A-3)
3. Ionization energy (Appendix A, Table A-3)
4. Electronegativity (Page 303 Table 12.1)
5. Electron Affinity (page 263 table 10.5)
6. Density (Appendix A, Table A-3)
7. Melting point (Appendix A, Table A-3).
8. Specific Heat (Appendix A, Table A-3)
9. Abundance on Earth's Crust (Appendix A, Table A-3).

Prepping the Element Straws

Read number seven (7) on the lab handout:

Add 1.0cm to each length you calculated

On Your Well Plate

H											He
Li	Be					B	C	N	O	F	Ne
Na	Mg					Al	Si	P	S	Cl	Ar
K	Ca					Ga	Ge	As	Se	Br	Kr
Rb	Sr					In	Sn	Sb	Te	I	Xe

Home Work

8.Nov.17

H											He
Li	Be					B	C	N	O	F	Ne
Na	Mg					Al	Si	P	S	Cl	Ar
K	Ca					Ga	Ge	As	Se	Br	Kr
Rb	Sr					In	Sn	Sb	Te	I	Xe

I. Finish calculations for your assigned trend so you arrive to class with all the Straw Length calculated in cm.

II. Have the definition of the trend recorded at the top of your lab

III. Written explanation of the trend in your own words

Bell Work

9-Nov-2017

Have your Straw Scale 3D periodic trend data and definition out and ready build.

Get a Yellow Card and legibly write the trend name in large letters and the definition below.

Include a Description of the trend

Ex. "Atomic Fortitude"



Atomic Fortitude

The ability of an element to remain in the Land of Oz without any loss of energy from or attraction to Krypton

Increases to right and Down a Row

OBJECTIVES:

- **Begin to understand the trends on the periodic table as seen through a 2D graph and be able to explain the current modern arrangement/ section of the periodic table according to periodic law**

A Better Arrangement

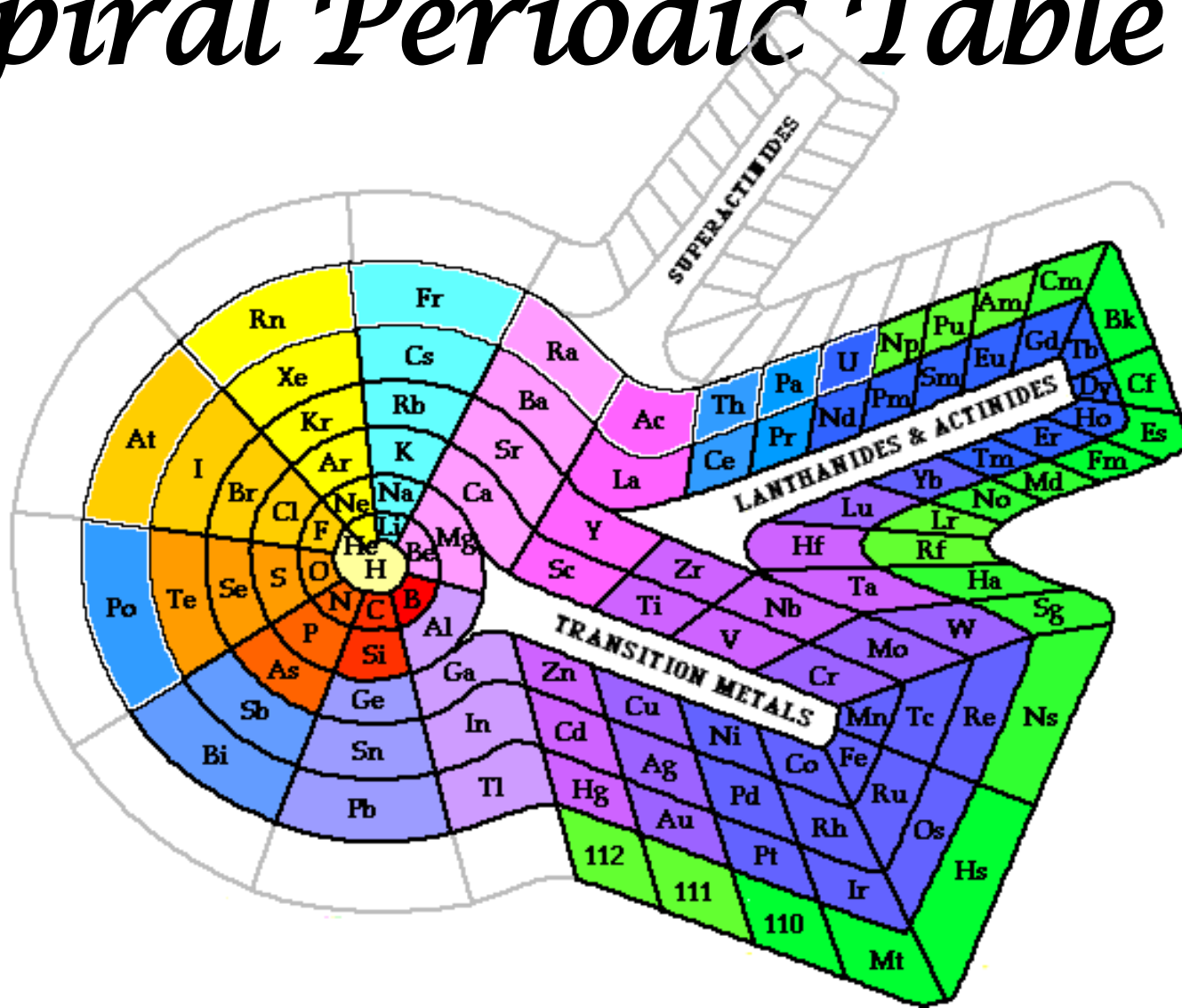


In 1913, Henry Moseley – British physicist, arranged elements according to increasing atomic number

The arrangement used today

**The symbol, atomic number & mass are basic items included-
textbook page 144 and 145**

Another possibility: Spiral Periodic Table



The Periodic Law says:

When elements are arranged in order of increasing atomic number, there is a **periodic repetition** of their physical and chemical properties.

Horizontal rows = periods

There are 7 periods

Vertical column = group (or family)

Similar physical & chemical prop.

Identified by number & letter (IA, IIA)

Areas of the periodic table

Three classes of elements are

- 1) metals
- 2) nonmetals
- 3) Metalloids



Metals: electrical conductors, have luster, ductile, malleable

Nonmetals: generally brittle and non-lustrous, poor conductors of heat and electricity

Optional Activity: Interactive Periodic Trends: A Graphical Experience.

Please open up the file “Online Periodic Properties” in the homework section of the class website (not loaded yet, Nov2017).

You should complete the handout on a separate sheet of paper.

http://academic.pgcc.edu/~ssinex/excelets/PT_interactive.xls

Areas of the periodic table

Some nonmetals are **gases**

(**O, N, Cl**); some are brittle solids (**S**); **one**
is a fuming dark red liquid (Br)

Notice the heavy, stair-step line?

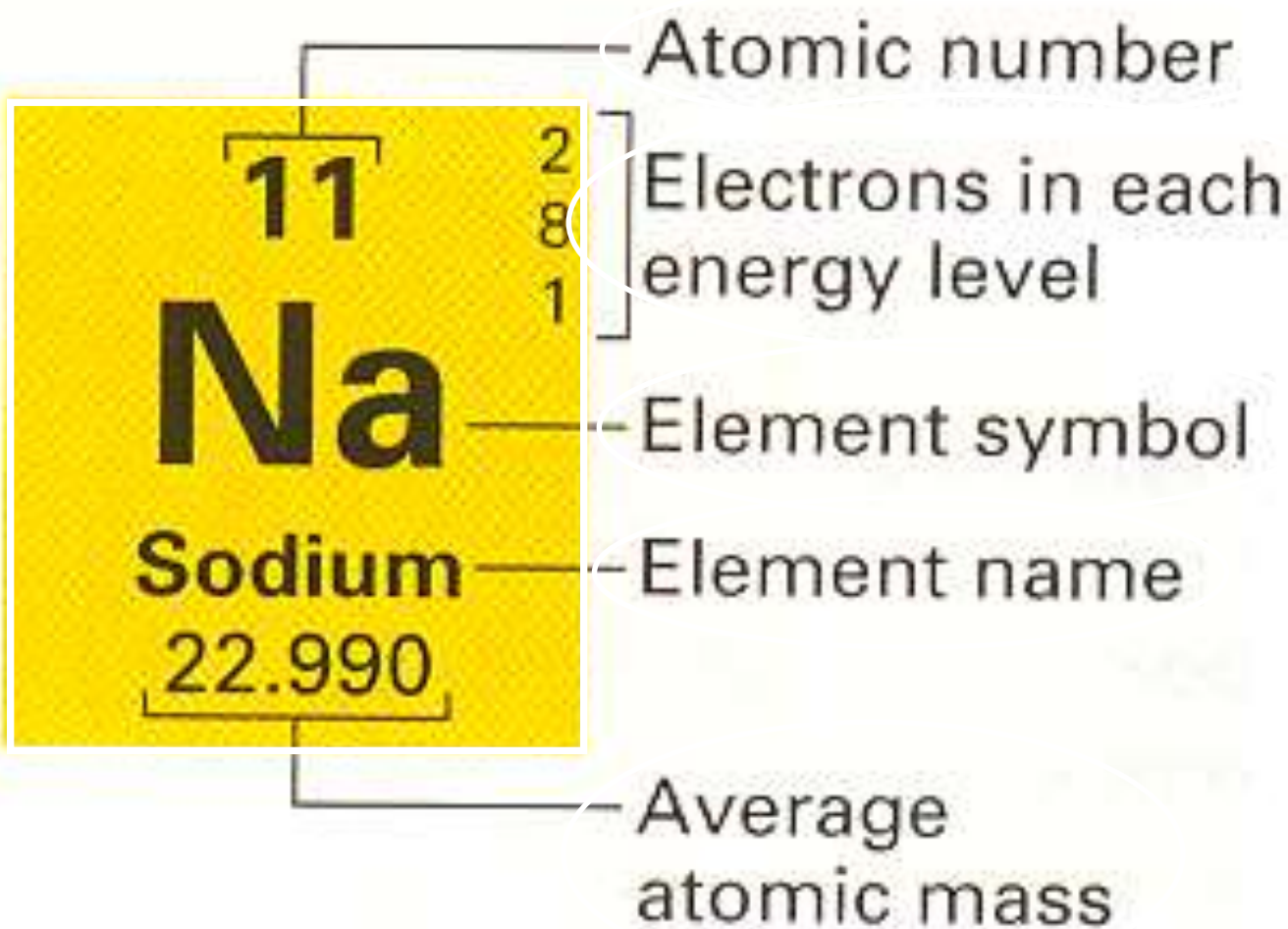
Metalloids: border the line-2 sides

Properties are intermediate between
metals and nonmetals

Tiles on the Periodic Table

The periodic table displays the symbols and names of the elements, along with information about the structure of their atoms:

- Atomic number and atomic mass
- Black symbol = solid;
- red = gas;
- blue = liquid
- (from the Periodic Table on our classroom wall)



Groups of elements - family names

Group IA – alkali metals

Forms a “base” (or alkali) when reacting with water (not just dissolved!)

Group IIA – alkaline earth metals

Also form bases with water; do not dissolve well, hence “earth metals”

Group VIIA – halogens

Means “salt-forming”

Electron Configurations in Groups

Elements can be sorted into 4 different groupings based on their electron configurations:

Noble gases

Representative elements

Transition metals

Inner transition metals

3D Plotting Trends

As a group you will introduce your “trend”

On the green card, you will draw a rectangle (to represent the periodic table) and record the trends.

Plotting Trends

A Periodic Table Activity

Tips: Find the **maximum** value of the assigned physical property for the elements you are assigned

Let the length of the straw minus one (1.0) cm represent this maximum value

Use this portion
of the straw

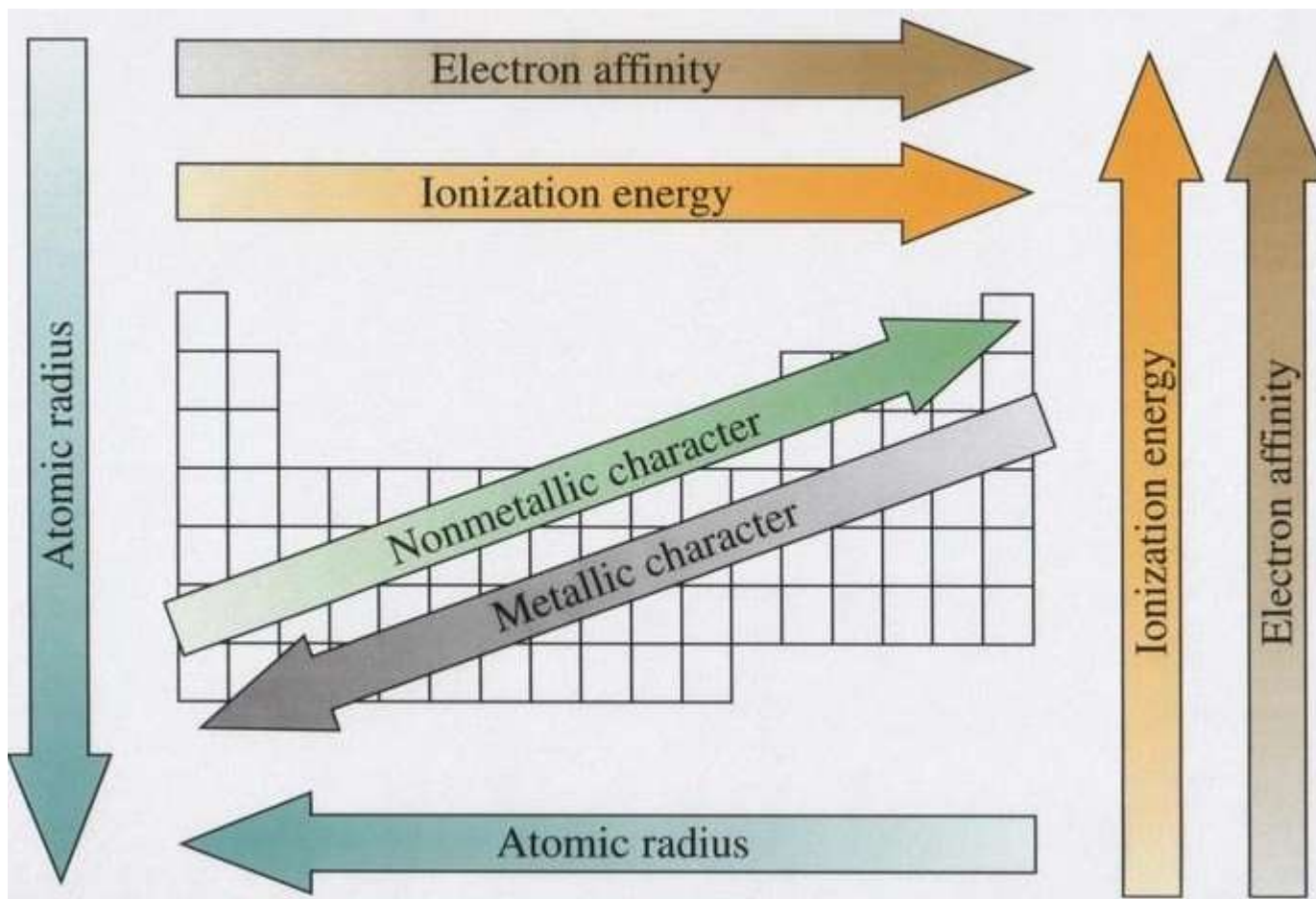
Using this “straw” scale as a ratio, calculate the straw length that is needed to represent the assigned property for each element in your list



On Your Well Plate

H											He
Li	Be					B	C	N	O	F	Ne
Na	Mg					Al	Si	P	S	Cl	Ar
K	Ca					Ga	Ge	As	Se	Br	Kr
Rb	Sr					In	Sn	Sb	Te	I	Xe

Periodic Trends



How would you describe the trend for atomic radius going from left to right across a period?

Down a group?

Recall

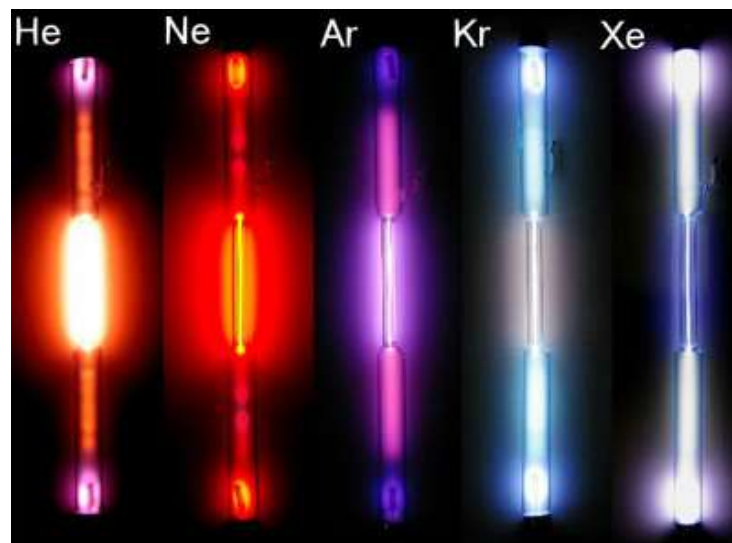
What is ionization energy?

What is an ion?

Nobel Gases

Noble gases are the elements in **Group 8A, VIIIA** (also called Group 18)

Previously called “inert gases” because they rarely take part in a reaction; very stable = don't react



Question

What are the three classes of elements (hint: not the phases)

Representative Elements

Representative Elements are in Groups 1A through 7A

Display wide range of properties, thus a good “representative”

Some are metals, or nonmetals, or metalloids; some are solid, others are gases or liquids

1A	2A
1 H 1.0079	
3 Li 6.941	4 Be 9.012
11 Na 22.990	12 Mg 24.305
19 K 39.098	20 Ca 40.078
37 Rb 85.468	38 Sr 87.62
55 Cs 132.905	56 Ba 137.327
87 Fr 223	88 Ra 226.025

III A	IV A	V A	VI A	VII A	VIII A
5 B 10.811	6 C 12.011	7 N 14.007	8 O 15.999	9 F 18.998	10 Ne 20.180
13 Al 26.982	14 Si 28.086	15 P 30.974	16 S 32.066	17 Cl 35.453	18 Ar 39.948
31 Ga 69.723	32 Ge 72.61	33 As 74.922	34 Se 78.96	35 Br 79.904	36 Kr 83.8
49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.60	53 I 126.905	54 Xe 131.29
81 Tl 204.383	82 Pb 207.2	83 Bi 208.980	84 Po 209	85 At 210	86 Rn 222
	114		116		118

Transition Metals

Transition metals are in the “B” columns of the periodic table

A “transition” between the metal area and the nonmetal area

Examples are gold, platinum, silver



Transition Metals									
1B	2B	3B	4B	5B	6B	7B	8	9	10
21 Sc 44.956	22 Ti 47.88	23 V 50.942	24 Cr 51.996	25 Mn 54.938	26 Fe 55.845	27 Co 58.933	28 Ni 58.69	29 Cu 63.546	30 Zn 65.39
39 Y 88.906	40 Zr 91.224	41 Nb 92.906	42 Mo 95.94	43 Tc 98	44 Ru 101.07	45 Rh 102.906	46 Pd 106.42	47 Ag 107.868	48 Cd 112.411
57 La 138.906	72 Hf 178.49	73 Ta 180.948	74 W 183.84	75 Re 186.207	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.967	80 Hg 200.59
89 Ac 227.028	104 Rf 261	105 Db 262	106 Sg 263	107 Bh 262	108 Hs 265	109 Mt 266	110 Uun 269	111 Uuu 272	112 Uub 277

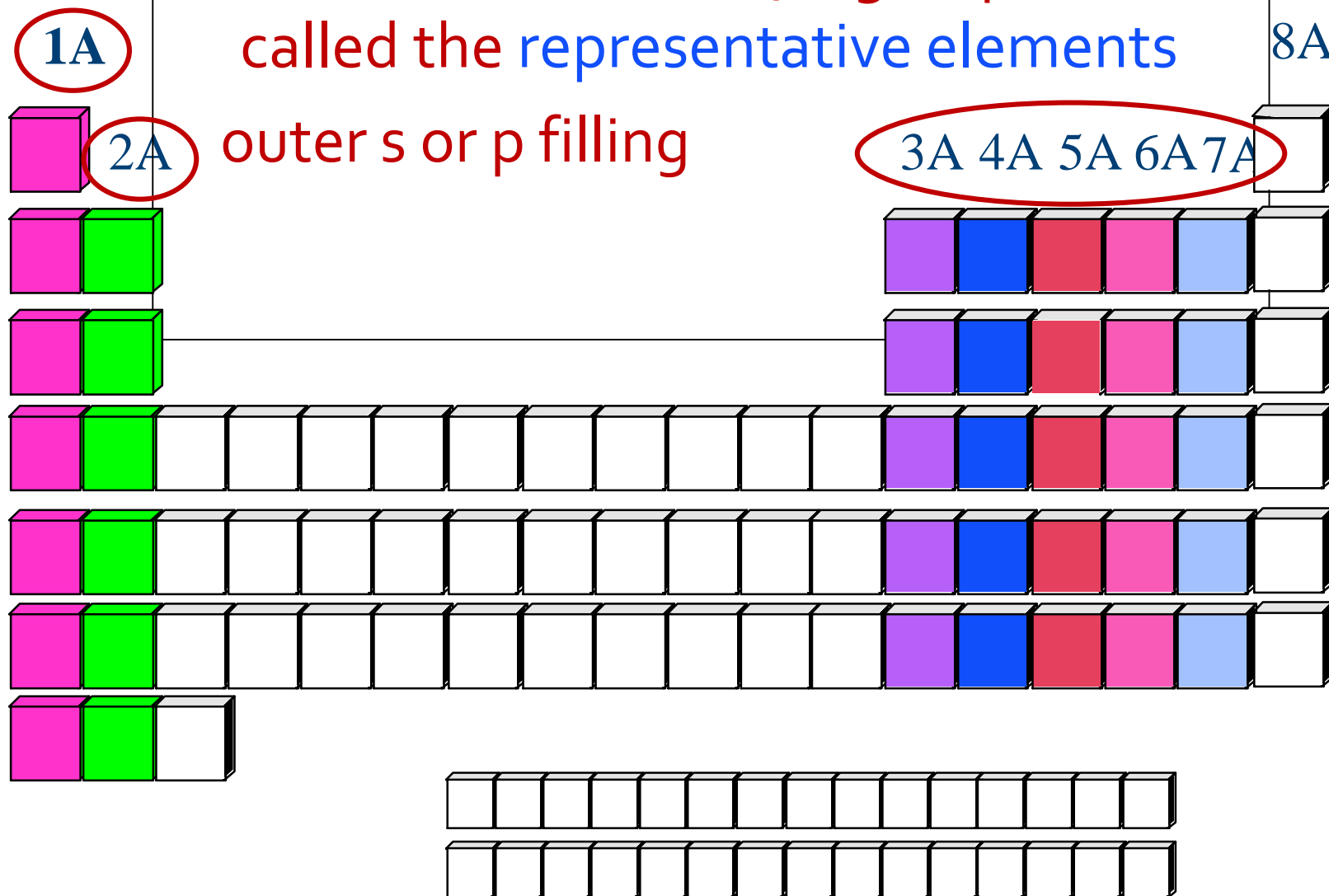
Inner Transition Metals

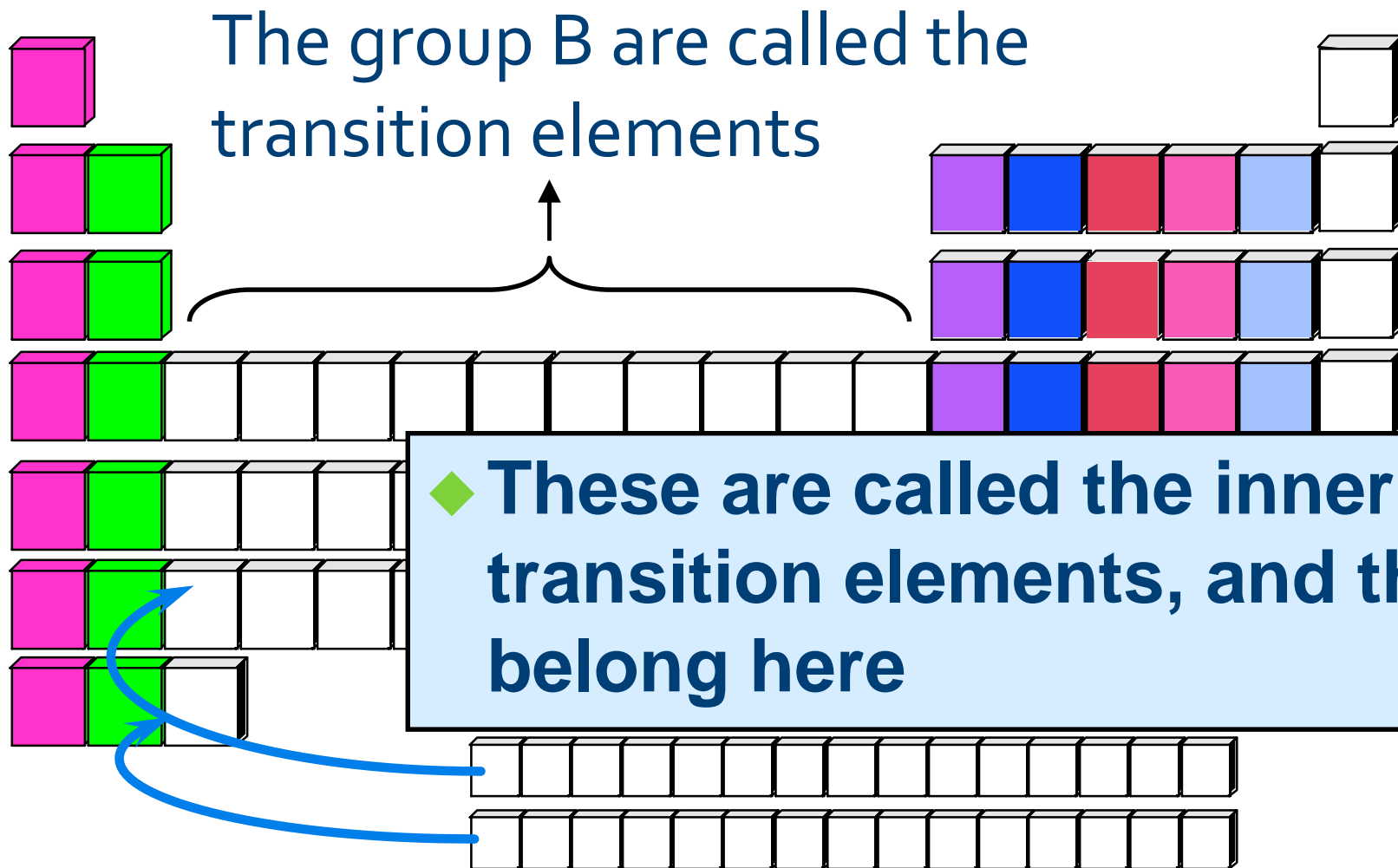
Inner Transition Metals are located below the main body of the table, in two horizontal rows

Formerly called “rare-earth” elements, but this is not true because some are very abundant

RARE EARTH ELEMENTS													
58 Ce 140.115	59 Pr 140.908	60 Nd 144.24	61 Pm 145	62 Sm 150.36	63 Eu 151.964	64 Gd 157.25	65 Tb 158.925	66 Dy 162.5	67 Ho 164.93	68 Er 167.26	69 Tm 168.934	70 Yb 173.04	71 Lu 174.967
90 Th 232.038	91 Pa 231.036	92 U 238.029	93 Np 237.048	94 Pu 244	95 Am 243	96 Cm 247	97 Bk 247	98 Cf 251	99 Es 252	100 Fm 257	101 Md 288	102 No 259	103 Lr 262

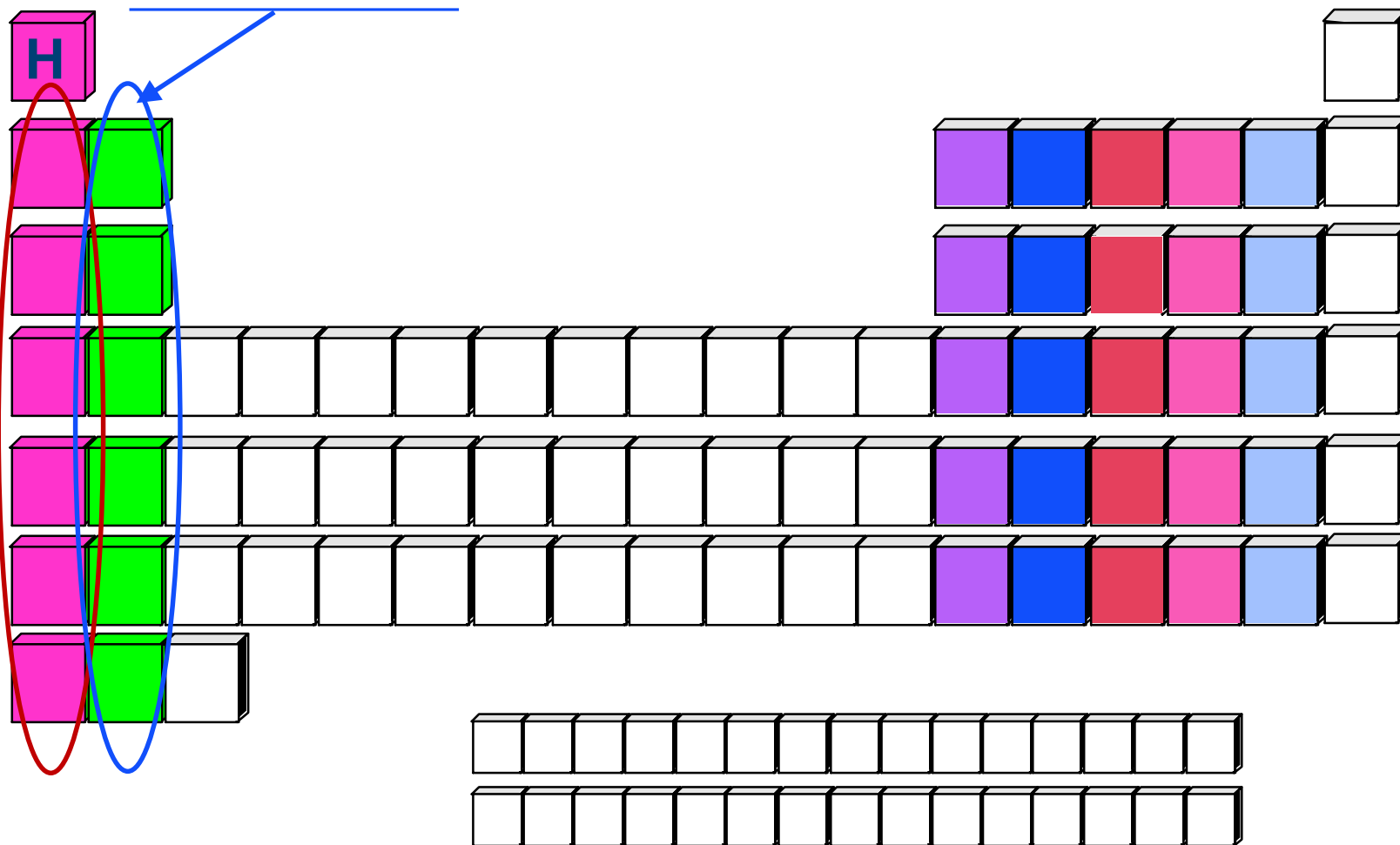
- Elements in the 1A-7A groups are called the representative elements



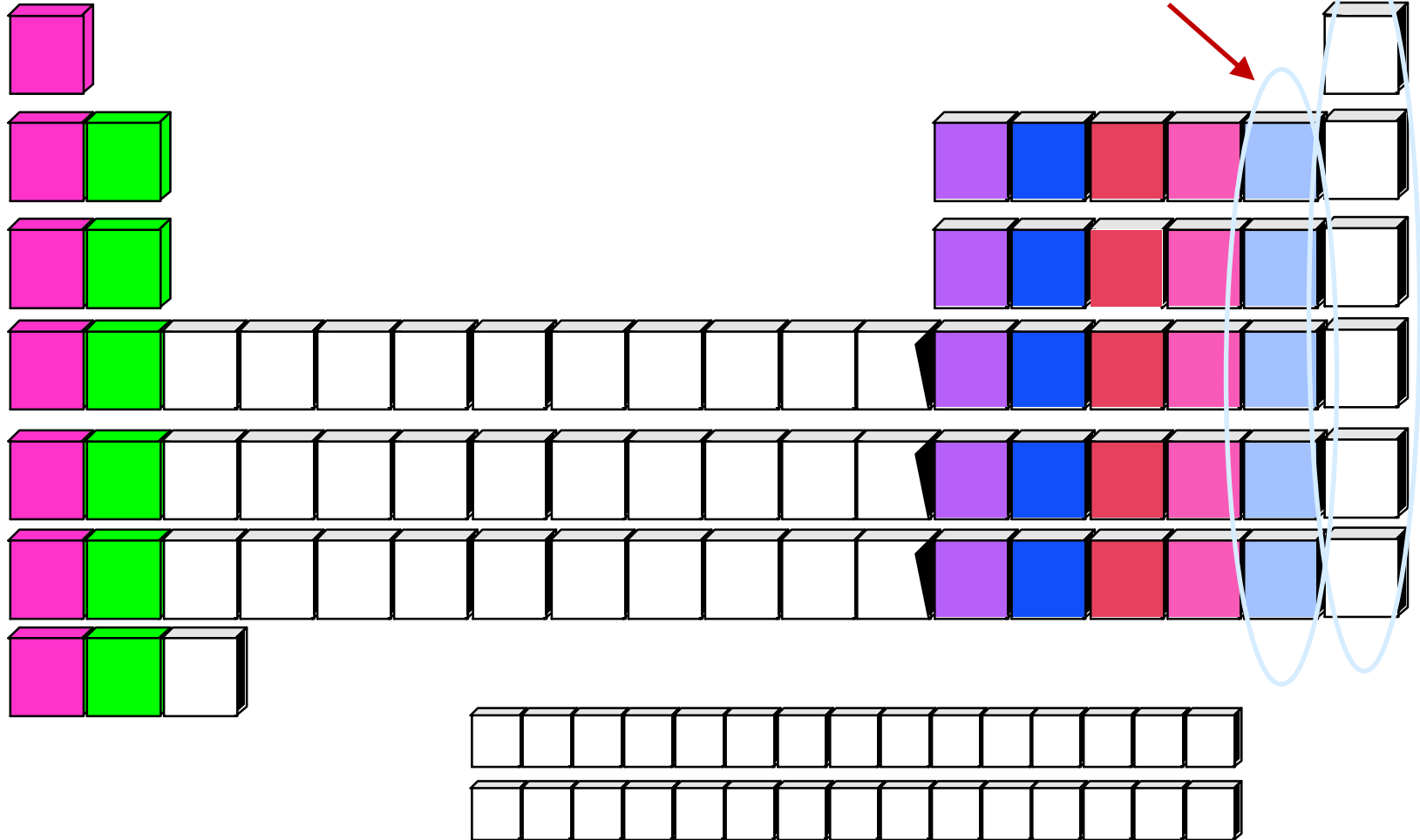


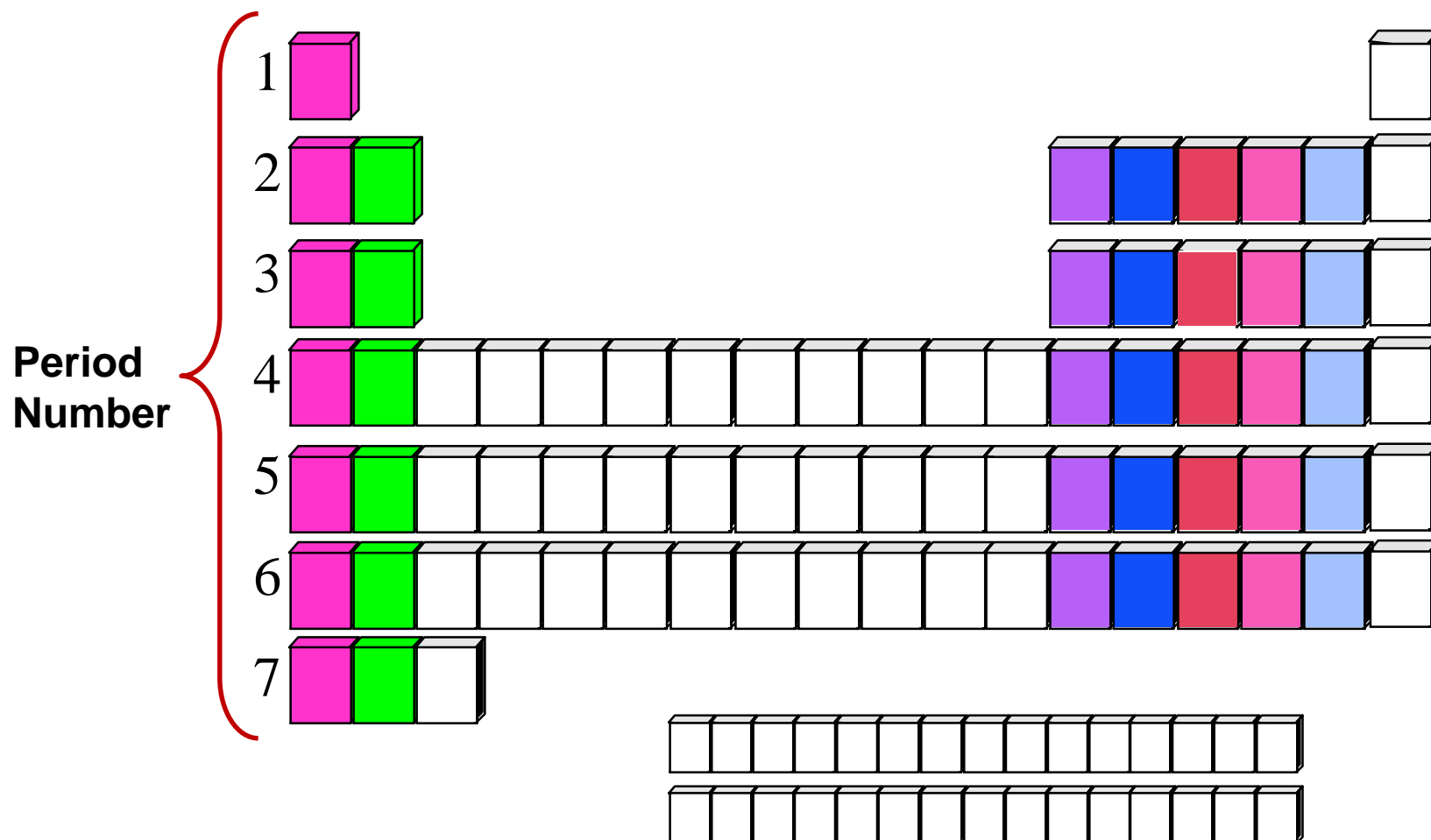
Group 1A are the alkali metals (but NOT H)

↓ Group 2A are the alkaline earth metals



- Group 8A are the noble gases
- Group 7A is called the halogens



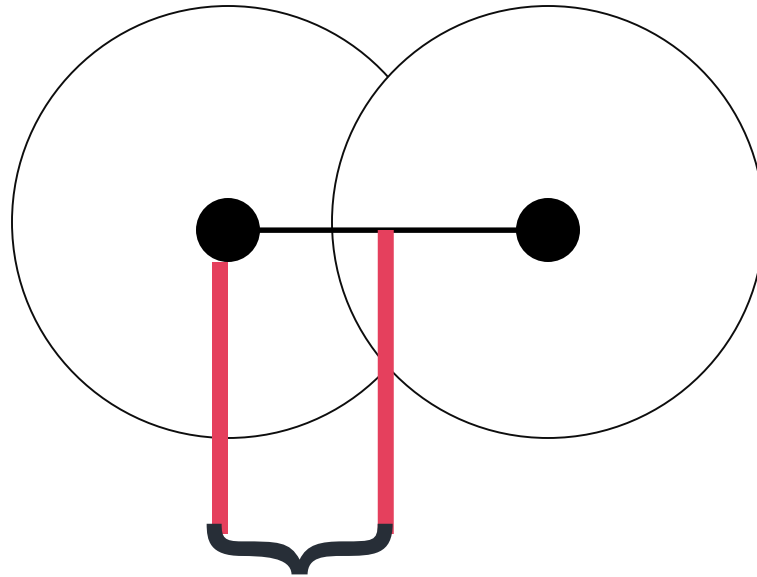


- Each row (or period) is the energy level for s and p orbitals.

Trends in Atomic Size

- First problem: Where do you start measuring from?
- The electron cloud doesn't have a definite edge.
- They get around this by measuring more than 1 atom at a time.

Atomic Size



Radius

- Measure the Atomic Radius - this is half the distance between the two nuclei of a diatomic molecule.

ALL Periodic Table Trends

- Influenced by three factors:
 1. Energy Level
 - Higher energy levels are further away from the nucleus.
 2. Charge on nucleus (# protons)
 - More charge pulls electrons in closer. (+ and – attract each other)
- 3. Shielding effect (blocking effect?)

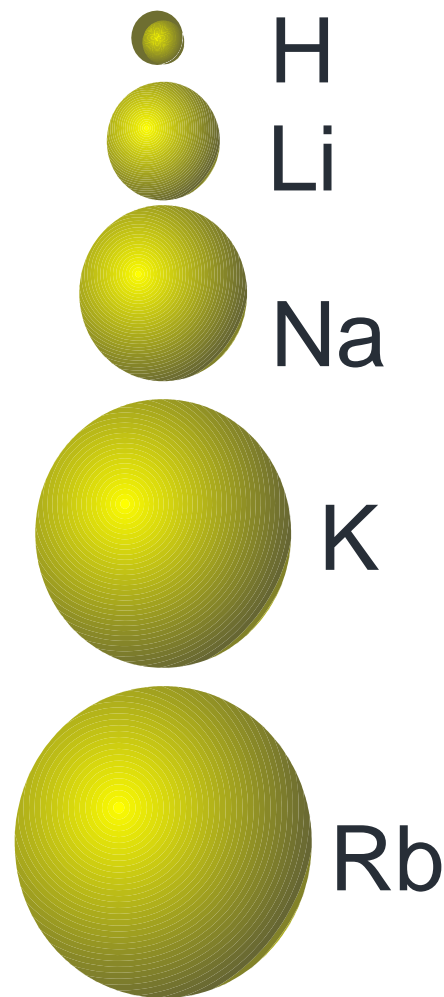
What do they influence?

Energy levels and Shielding have
an effect on the *GROUP*

Nuclear charge has an effect on a
PERIOD

#1. Atomic Size - Group trends

- As we increase the atomic number (or go down a group). . .
- each atom has another energy level,
- so the atoms get *bigger*.



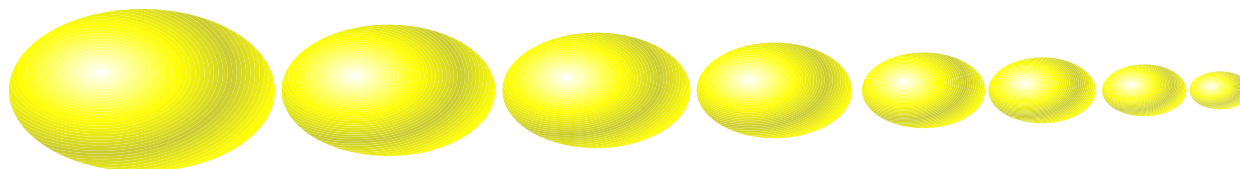
#1. Atomic Size - Period Trends

Going from left to right across a period, the size gets smaller.

Electrons are in the same energy level.

But, there is more nuclear charge.

Outermost electrons are pulled closer.



Na

Mg

Al

Si

P

S

Cl Ar

Ions

Some compounds are composed of particles called “ions”

- An **ion** is an atom (or group of atoms) that has a *positive or negative charge*

Atoms are neutral because the number of protons equals electrons

- Positive and negative ions are formed when electrons are *transferred* (lost or gained) between atoms

Ions

Metals tend to LOSE electrons, from their outer energy level

- Sodium loses one: there are now more protons (11) than electrons (10), and thus a positively charged particle is formed = **"cation"**
- The charge is written as a number followed by a plus sign: Na^{1+}
- Now named a **"sodium ion"**

Ions

Nonmetals tend to GAIN one or more electrons

- Chlorine will gain one electron
- Protons (17) no longer equals the electrons (18), so a charge of -1
- Cl^{1-} is re-named a “chloride ion”
- Negative ions are called “**anions**”

#2. *Trends in Ionization Energy*

- Ionization energy is the amount of energy required to *completely remove an electron* (from a gaseous atom).
- Removing one electron makes a 1+ ion.
- The energy required to remove only the first electron is called the first ionization energy.

Ionization Energy

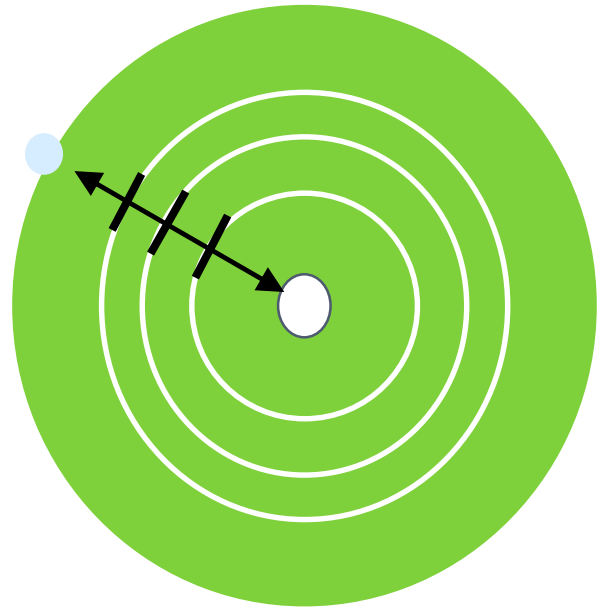
- The second ionization energy is the energy required to remove the second electron.
 - Always greater than first IE.
- The third IE is the energy required to remove a third electron.
 - Greater than 1st or 2nd IE.

What factors determine IE

- The greater the nuclear charge, the *greater* IE.
- Greater distance from nucleus *decreases* IE
- Filled and half-filled orbitals have lower energy, so achieving them is easier, lower IE.
- Shielding effect

Shielding

- The electron on the outermost energy level has to look through all the other energy levels to see the nucleus.
- Second electron has same shielding, if it is in the same period



Ionization Energy - Group trends

As you go down a group, the first IE decreases because...

- The electron is further away from the attraction of the nucleus, and
- There is more shielding.

Ionization Energy - Period trends

- All the atoms in the same period have the same energy level.
- Same shielding.
- But, increasing nuclear charge
- So IE generally increases from left to right.
- Exceptions at full and $1/2$ full orbitals.

Driving Forces

- Full Energy Levels require lots of energy to remove their electrons.
 - Noble Gases have full orbitals.
- Atoms behave in ways to try and achieve a noble gas configuration.

2nd Ionization Energy

For elements that reach a filled or half-filled orbital by removing 2 electrons, 2nd IE is lower than expected.

True for s^2

Alkaline earth metals form 2+ ions.

3rd IE

- Using the same logic s^2p^1 atoms have a low 3rd IE.
- Atoms in the aluminum family form 3+ ions.
- 2nd IE and 3rd IE are always higher than 1st IE!!!

Trends in Ionic Size: Cations

- Cations form by losing electrons.
- Cations are smaller than the atom they came from – not only do they lose electrons, they lose an *entire energy level*.
- Metals form cations.
- Cations of representative elements have the noble gas configuration before them.

Ionic size: Anions

- Anions form by gaining electrons.
- Anions are bigger than the atom they came from – have the same energy level, but a greater area the nuclear charge needs to cover
- Nonmetals form anions.
- Anions of representative elements have the noble gas configuration after them.

Configuration of Ions

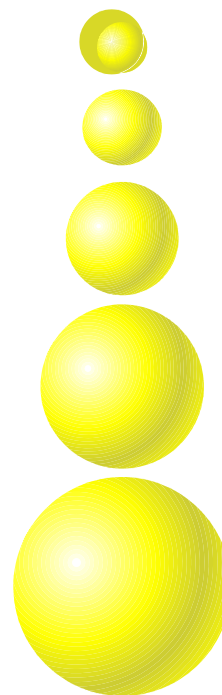
- Ions always have noble gas configurations (= a full outer level)
- Na atom is: $1s^2 2s^2 2p^6 3s^1$
- Forms a 1+ sodium ion: $1s^2 2s^2 2p^6$
- Same configuration as neon.
- Metals form ions with the configuration of the noble gas before them - they lose electrons.

Configuration of Ions

- Non-metals form ions by gaining electrons to achieve noble gas configuration.
- They end up with the configuration of the noble gas after them.

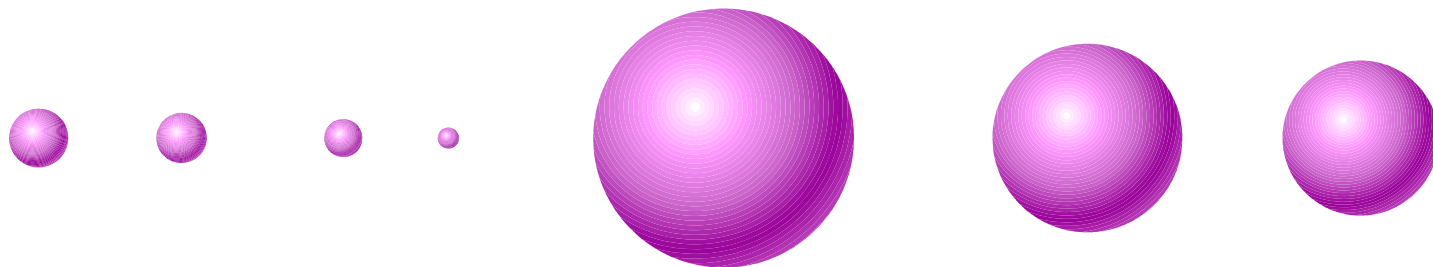
Ion Group trends

- Each step down a group is adding an energy level
- Ions therefore get bigger as you go down, because of the additional energy level.



Ion Period Trends

- Across the period from left to right, the nuclear charge increases - so they get smaller.
- Notice the *energy level changes* between anions and cations.

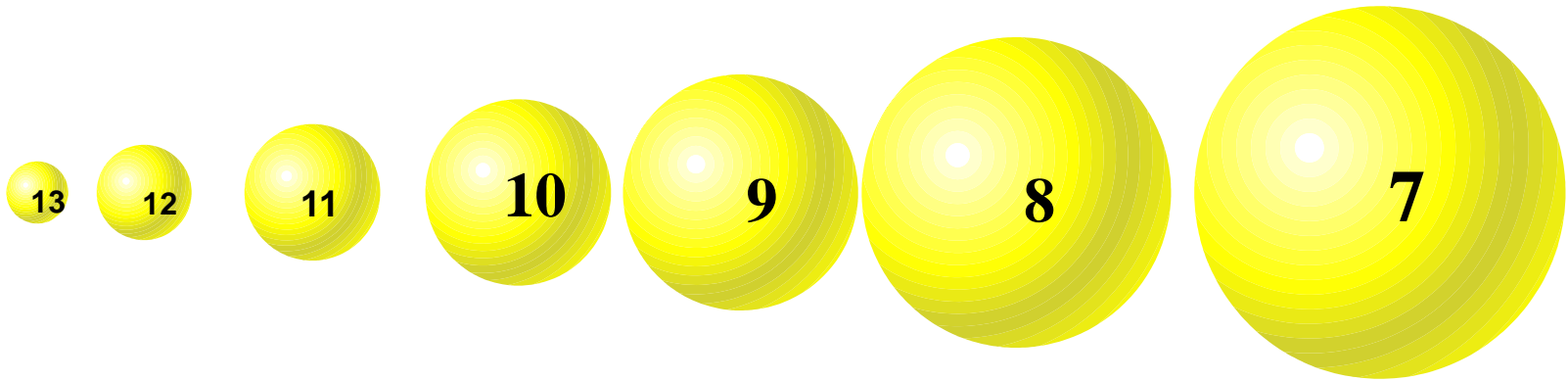


Size of Isoelectronic ions

- Iso- means “the same”
- Isoelectronic ions have the same # of electrons
- Al^{3+} Mg^{2+} Na^{1+} Ne F^{1-} O^{2-} and N^{3-}
 - all have 10 electrons
- all have the same configuration:
 $1s^2 2s^2 2p^6$ (which is the noble gas: neon)

Size of Isoelectronic ions?

- Positive ions that have more protons would be smaller (more protons would pull the same # of electrons in closer)



#3. Trends in Electronegativity

Electronegativity is the tendency for an atom to attract electrons to itself when it is chemically combined with another element.

They share the electron, but how equally do they share it?

An element with a big electronegativity means it pulls the electron towards itself strongly!

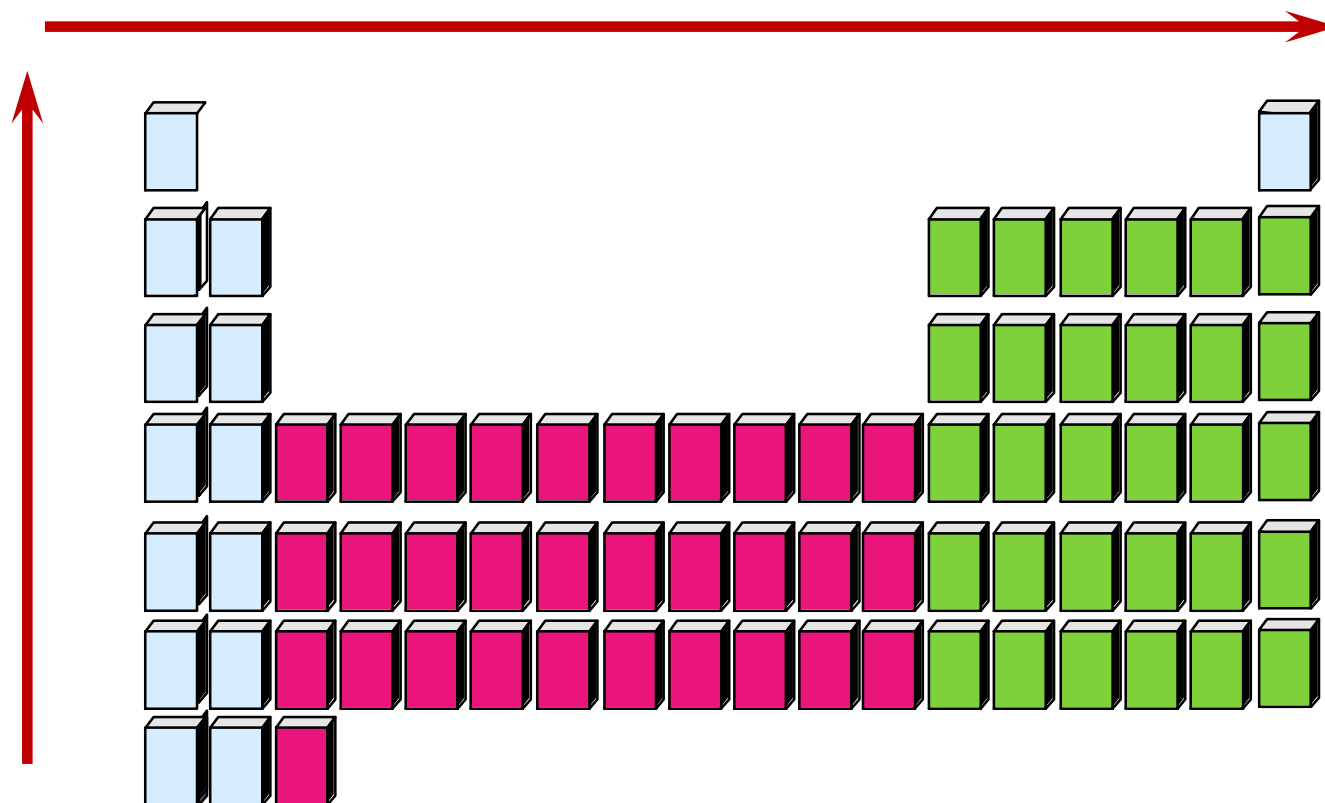
Electronegativity Group Trend

- The further down a group, the farther the electron is away from the nucleus, plus the more electrons an atom has.
- Thus, more willing to share.
- Low electronegativity.

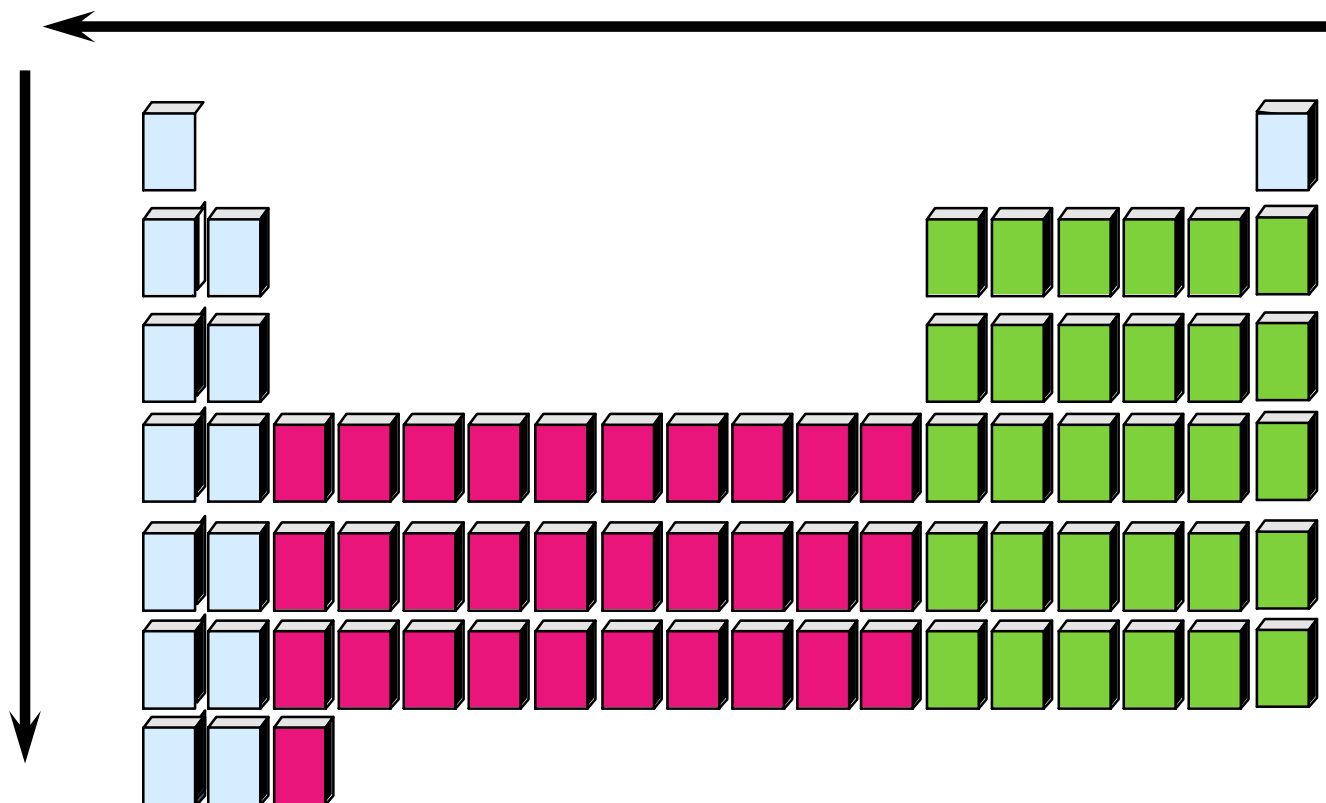
Electronegativity Period Trend

- Metals are at the left of the table.
- They let their electrons go easily
- Thus, low electronegativity
- At the right end are the nonmetals.
- They want more electrons.
- Try to take them away from others
- High electronegativity.

The arrows indicate the trend:
Ionization energy and Electronegativity
INCREASE in these directions



Atomic size and Ionic size increase
in these directions:



Bell Work

13-Nov-2017

What is the **energy** associated with a photon from a **380nm** black light?

What are the three (3) classes of elements (hint: not the phases)?

The last two (2) columns on the periodic table are refereed to as...?

OBJECTIVES:

**You will be able to identify the sections
and specific trends on the periodic
table**

Turn in Bell Work